

REMARKS

The present amendment is submitted in response to the Office Action mailed February 15, 2005. Claims 1, 3-9 and 11-26 are currently pending in the application. By this amendment, Claims 1, 9, 13, 15, 17, 19, 21 and 25 have been amended. No new matter or issues are believed to be introduced by this amendment. In view of the amendments above and the remarks to follow, reconsideration and allowance of this application are respectfully requested.

35 U.S.C. §103(a)

In the Office Action, Claims 1, 3, 9, 11, 15, 17, 19, 21 and 23-26 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. 6,078,879 (Taori).

Applicants respectfully traverse the rejection of claims 1, 3, 9, 11, 15, 17, 19, 21 and 23-26 under 35 U.S.C. §103(a), however, Claims 1, 9, 15, 19, 21 and 25 have been amended. It is respectfully submitted that claims 1, 3, 9, 11, 15, 17, 19, 21 and 23-26 are patentable over Taori for at least the following reasons, where also the prior arguments made in previously filed Amendments are incorporated herein by reference.

In Taori, a speech signal is segmented and parameters are determined to represent each segment (see Taori @ Col. 3, lines 20-48 and line 62).

The buffer 11 presents blocks of 400 DC filtered speech samples to a voiced speech encoder 16 according to the invention. Said block of 400 samples comprises 5 frames of 10 ms of speech (each 80 samples). It comprises the frame presently to be encoded, two preceding and two subsequent frames.

[Emphasis Added]

The output of a speech encoder comprises a pitch value, a gain value and a representation of 16 prediction parameters that are applied to the input of a multiplexer 22. (See Taori @ Col. 3, lines 58-61).

In the voiced speech encoder 16 the input signal is represented as a plurality of harmonically related sinusoidal signals. The output of the voiced speech encoder provides a pitch value, a gain value and a representation of 16 prediction parameters. The pitch value and the gain value are applied to corresponding inputs of a multiplexer 22. [Emphasis Added]

The pitch value is a single course pitch value representative of the continuously changing pitch during the entire segment. The frequency of the single course pitch value is then varied with the aim of refining or tuning its value. Specifically, the single course pitch value is refined (tuned) to the average value of the pitch within the segment. (See Taori @ Col. 4, lines 54-68 thru Col. 5, lines 1-9 and Fig. 3).

The pitch determination means according to the inventive concept comprise initial pitch determining means, being here a pitch estimator 38, and pitch tuning means, being here a Pitch Range Computer 34 and a Refined Pitch Computer 32. The pitch estimator 38 determines a coarse pitch value which is used in the pitch range computer 34 for determining the pitch values which are to be tried in the pitch tuning means further to be referred to as Refined Pitch Computer 32 for determining the final pitch value. The pitch estimator 38 provides a coarse pitch period expressed in a number of samples. The pitch values to be used in the Refined Pitch Computer 32 are determined by the pitch range computer 34 from the coarse pitch period according to the table below. [Emphasis Added]

As a consequence of transmitting a single refined pitch value (i.e., the final pitch value), the decoder of Taori renders a signal with a constant pitch and constant spectral envelope during each segment. (See Taori @ Col. 10, lines 28-30, equation 23, Figs. 7 and 8).

The harmonic oscillator bank 108 generates the plurality of harmonically related signals $s_{v,k}[n]$ that represents the speech signal. This calculation is performed using the harmonic amplitudes $m[i]$, the frequency f_0 and the synthesized phases $\phi[i]$ [Emphasis Added]

In sharp contrast with Taori, in addition to transmitting a signal representing a frequency of at least one periodical component, the system and method of the invention transmits two further signals. A first further signal representing *a frequency change of at least one periodical component of the audio signal over a predetermined amount of time (segment) to be used by said decoder for deriving said reconstructed audio signal*, as presently recited in independent claims 1, 9, 15, 19, 21 and 25, and a second further signal representing *an average frequency of the at least one periodical component of the audio signal over the predetermined amount of time*, as recited in independent claims 1, 9, 15, 19, 21 and 25 as amended.

The transmission of the two additional signals improves the quality of the reconstructed audio signal. The first additional signal (referred to in the specification as parameter "a") is used on both the transmitter side and on the receiver side. On the transmitter side, the warping parameter "a" serves to facilitate a time warping operation on the source signal to remove the pitch variation in the source signal. By time warping the source signal, it is transformed into a more stationary output signal that is better suited to coding. Using the time warped signal, a better estimation of the transmitted parameters representing the source signal is obtained which translates into a better representation of the source signal.

On the receiver side, the two additional signals are received:

1. the average frequency of the at least one periodical component of the audio signal over the predetermined amount of time, referred to in the specification as PITCH, and
2. The average time warping signal, "a", representing the frequency change of the source signal, at the receiver, the pitch variation)

The two signals facilitate an operation whereby the time varying pitch variation of the source signal is re-introduced into the received signal, resulting in an improved quality of the reconstructed source signal.

It is respectfully submitted that there is no teaching or suggestion in Taori of transmitting two additional signal (see 1 and 2 above) to provide pitch variation within each segment. Instead, as discussed above, Taori teaches the transmission of a single refined pitch parameter, tuned to the average value of the pitch within the segment. The single refined pitch parameter represents a constant pitch value used during the entire segment. As such, the single refined pitch parameter provides no information regarding pitch variation in the segment.

One drawback of transmitting a single refined pitch parameter in Taori is that the LPC analyzer operates on a basic instationary input speech segment and as a consequence the LPC parameters represent an average smeared spectral envelope of the speech segment. In contrast, the LPC analyzer of the invention operates on a time warped signal which is substantially stationary. As such, the LPC parameters give a better representation of the spectral envelope of the signal segment.

A further drawback of transmitting a single refined pitch parameter in Taori is that the output of the decoder renders a signal with a constant pitch and constant spectral

envelope during a segment. In contrast, the output of the decoder of the invention renders a signal with a time-varying pitch and a time-varying spectral envelope during a segment, just as in natural speech.

Accordingly, it is respectfully requested that the rejection under 35 U.S.C. §103(a) of independent claims 1, 9, 15, 17, 19, 21 and 25 be withdrawn, and independent claims 1, 9, 15, 17, 19, 21 and 25 be allowed. In addition, as Claims 3, 11, 23-24 and 26 depend from independent Claims 1, 9, 21 and 25, respectively, and therefore contain the limitations of Claims 1, 9, 21 and 25, applicants respectfully request that Claims 3, 11, 23-24 and 26 also be allowed over the prior art of record.

35 U.S.C. §103(a)

Dependent Claims 4, 5, 12, 14, 16, 18 and 22 were rejected under 35 U.S.C. §103(a) as being unpatentable over Taori in view of U.S. Patent No. 5,467,005 (hereinafter Wang).

Claims 4, 5, 12, 14, 16, 18 and 22 depend from Claims 1, 9, 13, 15, 17 and 21 respectively, and therefore includes the limitations of Claims 1, 9, 13, 15, 17 and 21. Accordingly, for the same reasons given above for Claims 1, 9, 13, 15, 17 and 21, Claims 4, 5, 12, 14, 16, 18 and 22 are believed to contain patentable subject matter. Accordingly, applicants respectfully request that Claims 4, 5, 12, 14, 16, 18 and 22 be allowed over the prior art of record.

35 U.S.C. §103(a)

Dependent Claims 6-8 were rejected under 35 U.S.C. §103(a) as being unpatentable over Taori in view of U.S. Patent No. 5,467,005 (hereinafter Wang) and further in view of Sluitzer et al., ("A Time warper for Speech Signals") (hereinafter Sluitzer).


Claims 6-8 depend from Claim 1 and therefore includes the limitations of Claim 1. Accordingly, for the same reasons given above for Claims 1, Claims 6-8 are believed to contain patentable subject matter. Accordingly, applicants respectfully request that Claims 6-8 be allowed over the prior art of record.

Conclusion

In view of the foregoing amendments and remarks, it is respectfully submitted that all claims presently pending in the application, namely, Claims 1, 3-9 and 11-26 are believed to be in condition for allowance and patentably distinguishable over the art of record.

If the Examiner should have any questions concerning this communication or feels that an interview would be helpful, the Examiner is requested to call Dicron Halajian, Esq., Intellectual Property Counsel, Philips Electronics North America, at 914-333-9607.

Respectfully submitted,



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